

PA  
NT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION  
(PCT Rule 61.2)

Date of mailing (day/month/year)  
18 July 2000 (18.07.00)

To:  
  
Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

International application No.  
PCT/NL99/00664

Applicant's or agent's file reference  
BO 42162

International filing date (day/month/year)  
28 October 1999 (28.10.99)

Priority date (day/month/year)  
03 November 1998 (03.11.98)

## Applicant

BERKHOFF, Arthur, Perry et al

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

30 May 2000 (30.05.00)

in a notice effecting later election filed with the International Bureau on:

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2. The election  was  
 was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

BEST AVAILABLE COPY

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer

S. Mafla

Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38

Nederlandsch Octrooibureau

## PATENT COOPERATION TREATY

INGEK. 22 MEI 2000

PCT

Paraaf Bewerken

## NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

DE BRUIJN, Leendert, C.  
 Nederlandsch Octrooibureau  
 Scheveningseweg 82  
 P.O. Box 29720  
 NL-2502 LS The Hague  
 PAYS-BAS

Date of mailing (day/month/year)

11 May 2000 (11.05.00)

Applicant's or agent's file reference

BO 42162

## IMPORTANT NOTICE

International application No.

PCT/NL99/00664

International filing date (day/month/year)

28 October 1999 (28.10.99)

Priority date (day/month/year)

03 November 1998 (03.11.98)

Applicant

NEDERLANDSE ORGANISATIE VOOR TOEGEPAST-NATUURWETENSCHAPPELIJK  
 ONDERZOEK TNO et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,CN,JP,KP,KR,MA,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,GE,  
 GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MN,MW,MX,NO,NZ,OA,

PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on  
 11 May 2000 (11.05.00) under No. WO 00/26900

## REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

## REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland

Authorized officer

J. Zahra

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## PATENT COOPERATION TREATY

## PCT

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**  
**(PCT Article 36 and Rule 70)**

Applicant's or agent's file reference BO 42162	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/NL99/00664	International filing date (day/month/year) 28/10/1999	Priority date (day/month/year) 03/11/1998
International Patent Classification (IPC) or national classification and IPC G10K11/178		
Applicant <b>NEDERLANDSE ORGANISATIE VOOR TOEGEPAST-.....et al.</b>		
1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.		
2. This REPORT consists of a total of 5 sheets, including this cover sheet.		
<input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).		
These annexes consist of a total of 6 sheets.		
3. This report contains indications relating to the following items:		
I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application		

Date of submission of the demand 30/05/2000	Date of completion of this report 30.11.2000
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer <b>Zwicker, T</b> Telephone No. +49 89 2399 2841



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/NL99/00664

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).*):

**Description, pages:**

4-13	as originally filed		
1,2,2a,3	as received on	08/11/2000 with letter of	08/11/2000

**Claims, No.:**

1-6	as received on	08/11/2000 with letter of	08/11/2000
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**Drawings, sheets:**

1/12-12/12	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/NL99/00664

- the description,      pages:  
 the claims,      Nos.:  
 the drawings,      sheets:

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims	1-6
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-6
	No:	Claims	

Industrial applicability (IA)   Yes:   Claims   1-6  
                                  No:   Claims

**2. Citations and explanations  
see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NL99/00664

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The present application relates to active noise control.

Closest state of the art appears to be document D1 (GUO J ET AL: 'ACTIVELY CREATED QUIET ZONES BY MULTIPLE CONTROL SOURCES IN FREE SPACE' JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, vol. 101, no. 3, March 1997 (1997-03), pages 1492-1501) disclosing an arrangement of a plurality of secondary sound sources demitting sound to cancel out, at a location of a plurality of error sensors, noise originally generated by a primary sound source. The sensors and sources are respectively spaced apart among themselves by specific distances. The main issue discussed in D1 is the handling and processing of the multiple sensors and sources with respect to stability, and the generation of specific quiet zones in a locale.

Also of interest is D2 (ELLIOTT STEPHEN J ET AL: 'Interaction between multiple feedforward active control systems' IEEE TRANS SPEECH AUDIO PROCESS;IEEE TRANSACTIONS ON SPEECH AND AUDIO PROCESSING OCT 1994 IEEE, NEW YORK, NY, USA, vol. 2, no. 4, October 1994 (1994-10), pages 521-530) which deals with multiple sources and sensors, too, but concentrates on the issue of grouping them together for subprocessing within these groups.

The present application seeks to further develop a state of the art as e.g. given by D1 and achieve optimal noise reduction in an entire space.

Independent claim 1 starts out in its two-part form from D1 and then goes on to suggest that the secondary sources and the error sensors are arranged, respectively, in two-dimensional arrays. Both sources and senors are, with respect to signal processing, sub-grouped into subsets and interface with a plurality of controllers (this would be known from D2). The claim then further specifies the noise reduction to be achieved and that the arrangement of sensor- and secondary-sources-arrays is in rows and columns, which are spaced apart by a distance  $d_x$ . The two surfaces created by the arrays are spaced apart by a distance  $d$  which meets:  $0.5 \times d_x < d < d_x$ .

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NL99/00664

In particular this latter condition is apparently not pointed to by the available state of the art. It would therefore seem that the subject matter of present claim 1 is not obvious and thus meets the requirements of Art. 33 PCT.

Claims 2 - 6 related to advantageous embodiments of the approach taken by claim 1 and therefore would appear to also meet the requirements of Art. 33 PCT.

Noise reduction panel arrangement and method of calibrating such a panel arrangement

- The present invention relates to a noise reduction arrangement comprising:
- 5 - a plurality of actuators for generating secondary noise to reduce primary noise generated by at least one primary source;
  - a plurality of sensors for sensing the total amount of noise resulting from the primary noise after being reduced by the secondary noise and for generating a plurality of sensor signals;
  - 10 - control means for controlling the actuators based on the sensor signals, the distance between the first and second surfaces is selected to have an optimised reduction in power RP of the total amount of noise relative to the primary noise within a predetermined frequency band.

Such a noise reduction arrangement is known from J. Guo, e.a., "Actively created quiet zones by multiple control sources in free space", J. Acoust. Soc. Am. 101 (3), March 1997, pp. 1492-1501. This document discloses an arrangement with a series of secondary sources on a first line and a series of error sensors on a second line, the first and second lines being parallel. The primary concern of this document is to create large areas of quiet zones. The document observes that such a requirement can be satisfied if the error sensors are not in the near field of the secondary sources. According to the document, the distance between the second line with the error sensors and the first line with the secondary sources should be greater than or comparable to the mutual distances between the secondary sources. Guo e.a. only present a model for this two line arrangement. Moreover, in their model, all secondary sources are controlled by the output signals of all error sensors. Implementing such a control arrangement results in a complex controller with many connections and which turns out to be rather slow in many applications.

S.J. Elliott et al., Interaction Between Multiple Feedforward Active Control Systems, IEEE Transactions on Speech and Audio Processing, Vol. 2, No. 4, 1994, pp. 30 521-530 [1] describe a noise reduction system having a panel of actuators arranged in a first plane and a plurality of error sensors in a second plane. The first and second planes are parallel to one another. Elliott et al. present a mathematical model of a decentralised adaptive feedforward control system. They also present results of some physical exam-

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ART 34 AMDI

5       ples in which there are two actuators and two error sensors. In these examples, Elliott et al. introduce the mutual distances between the error sensors and the actuators as important parameters to derive conditions as to when such a system is stable. In the physical examples given, the distance between the two planes is about 0.3 times the distance between the two actuators. Elliott et al. do not disclose the presence of an optimum distance between the two planes as a function of the mutual distance between actuators.

10      X. Qui, e.a., A Comparison of Near-field Acoustic Error Sensing Strategies for the Active Control of Harmonic Free Field Sound Radiation, Journal of Sound and Vibration, 1998, 215(1), pp. 81-103 [2], disclose the results of a study to find the best location of an error sensor relative to a primary noise source. However, this study is limited to a harmonic sound field radiated by a monopole primary source and by a dipole-like pair of primary sources. In both cases the actuator is a monopole radiating at the same frequency as the primary source. No plurality of actuators and plurality of error sensors arranged in respective planes are disclosed.

15      An active high transmission loss panel is disclosed in WO-A-94/05005. However, in this patent document the actuators and sensors are all located in the same plane.

20      The present invention is directed to a noise reduction arrangement having a plurality of actuators in a first surface and a plurality of error sensors in a second surface in which the reduction of noise is optimised as a function of the distance between the surfaces and in which the control means are simplified. The surfaces may be planes, like in the arrangement of Elliott et al. [1], but they may also deviate from planes. They may, e.g., be slightly curved.

Thus, the noise reduction arrangement as defined above is characterised in that

- the plurality of actuators are located in a first surface;
- 25     • the plurality of sensors are located in a second surface arranged substantially parallel to the first surface;
- the plurality of actuators are sub-divided into a plurality of sub-sets of actuators;
- the control means comprise a plurality of controllers, each controller being arranged to receive sensor signals of a sub-set of said plurality of sensors and arranged to
- 30     control one single sub-set of actuators; and
- the reduction of power RP is within the following range:

$$0.9 \times RP_{max} \leq RP \leq RP_{max}$$

in which  $RP_{max}$  is maximum obtainable reduction in power of the total amount of noise

relative to the primary noise, where both RP and RP<sub>max</sub> are expressed in decibel.

The present invention is based on the insight that a maximum reduction shows up in the curve representing the reduction of the total amount of sound power relative to the primary noise as a function of the distance between the surfaces and that it is not necessary to have each actuator controlled by the output signals of each of the sensors. The actual optimum distance where the maximum occurs depends on several parameters, like the number of actuators, the number of sensors, the ratio between these two numbers, the actual arrangement of the actuators and the actual arrangement of the sensors. The optimum distance can be established by testing while increasing the distance between the surfaces from 0, while adjusting a predetermined control parameter ( $\beta$ ) to maintain stability.

Preferably, each controller is arranged to receive sensor signals of only those sensors which are within a predetermined range from said controller.

In one of the arrangements, the number of sensors equals the number of actuators and equals the number of controllers, each controller receiving one of the plurality of sensor signals as input signal and controlling one of the plurality of the actuators. When, in such an arrangement, the plurality of actuators are arranged in rows and columns, mutual distances between adjacent columns and mutual distances between adjacent rows are equal to a predetermined actuator distance d<sub>x</sub> and the plurality of sensors are arranged in the same way as the plurality of actuators, the distance d between the first and the second surfaces preferably meets the following condition:

$$0.5 \times d_x \leq d \leq d_x.$$

In one embodiment, the arrangement includes a supervising controller for monitoring long-term behaviour of the arrangement and for modifying control parameters of the controllers in order to ensure overall stability of the arrangement.

Hereinafter, the invention will be explained with reference to some drawings. The drawings and explanation are only given by way of example and are not intended to limit the scope of the present invention.

Figure 1a shows a front view of a plate provided with 48 actuators and 221 sensors in front of the plate;

Figure 1b shows a schematic cross section view of the arrangement according to figure 1a along line IB-IB in figure 1a;

Figure 1c shows a schematic electronic black box circuitry for controlling the

## **Claims**

1. Noise reduction arrangement comprising:

  - a plurality of actuators (3(n)) for generating secondary noise ( $p_s$ ) to reduce primary noise ( $p_p$ ) generated by at least one primary source (4);
  - a plurality of sensors (2(m)) for sensing the total amount of noise resulting from the primary noise after being reduced by the secondary noise and for generating a plurality of sensor signals ( $p(m)$ );
  - control means (5a(i), 5b(i)) for controlling the actuators (3(n)) based on the sensor signals ( $p(m)$ ),

5 the distance (d) between the first and second surfaces is selected to have an optimised reduction in power RP of the total amount of noise relative to the primary noise within a predetermined frequency band,  
characterised in that

  - the plurality of actuators (3(n)) are located in a first surface;
  - the plurality of sensors (2(m)) are located in a second surface arranged substantially parallel to the first surface;
  - the plurality of actuators (3(n)) are sub-divided into a plurality of sub-sets of actuators (3(n));
  - the control means (5a(i), 5b(i)) comprise a plurality of controllers (5a(i), 5b(i)), each controller (5a(i), 5b(i)) being arranged to receive sensor signals of a sub-set of said plurality of sensors (2(m)) and arranged to control one single sub-set of actuators (3(n)); and
  - the reduction of power RP is within the following range:
$$0.9 \times RP_{max} \leq RP \leq RP_{max}$$

10 in which  $RP_{max}$  is maximum obtainable reduction in power of the total amount of noise relative to the primary noise, where both RP and  $RP_{max}$  are expressed in decibel.

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2. Arrangement according to claim 1, wherein each controller (5a(i), 5b(i)) is arranged to receive sensor signals of only those sensors (2(m)) which are within a predetermined range from said controller (5a(i), 5b(i)).

3. Arrangement according to claim 1 or 2 wherein the number of sensors (2(m)) equals the number of actuators (3(n)) and equals the number of controllers (5a(i), 5b(i)),

each controller (5a(i), 5b(i)) receiving one of the plurality of sensor signals (p(m)) as input signal and controlling one of the plurality of actuators (3(n)).

5. Arrangement according to any of the preceding claims, wherein the plurality of actuators are arranged in rows and columns, mutual distances between adjacent columns and mutual distances between adjacent rows being equal to a predetermined actuator distance  $d_x$ , the plurality of sensors being arranged in the same way as the plurality of actuators, the distance  $d$  between the first and the second surfaces meeting the following condition:

10  $0.5 \times d_x \leq d \leq d_x$

6. Arrangement according to any of the preceding claims wherein a sound reflective wall (8) is present such that the second surface is between the first surface and the wall (8).

- 15 7. Arrangement according to any of the preceding claims wherein one or more detection sensors (7(r)) are arranged for sensing said primary source (4) and providing one or more detection sensor signals ( $v_{det}(i)$ ) to said plurality of controllers (5a(i), 5b(i)).

- 20 8. Arrangement according to any of the preceding claims wherein a supervising controller (6) is provided to receive signals in dependence on said sensor signals (p(m)) and to monitor long-term behaviour of the arrangement by modifying control parameters of the controllers (5a(i), 5b(i)) in order to ensure overall stability of the arrangement based on a predetermined error criterion as to the sensor signals (p(m)).

M.H

**PATENT COOPERATION TREATY  
PCT**

**INTERNATIONAL SEARCH REPORT**

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference  B0 42162	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No.  PCT/NL 99/ 00664	International filing date (day/month/year)  28/10/1999	(Earliest) Priority Date (day/month/year)  03/11/1998
Applicant  NEDERLANDSE ORGANISATIE VOOR TOEGEPAST-.....et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

- the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :
- contained in the international application in written form.
  - filed together with the international application in computer readable form.
  - furnished subsequently to this Authority in written form.
  - furnished subsequently to this Authority in computer readable form.
  - the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
  - the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2.  Certain claims were found unsearchable (See Box I).

3.  Unity of invention is lacking (see Box II).

4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

1B

- None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

P [REDACTED] L 99/00664

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G10K11/178

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G10K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>GUO J ET AL: "ACTIVELY CREATED QUIET ZONES BY MULTIPLE CONTROL SOURCES IN FREE SPACE"          JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA,          vol. 101, no. 3, March 1997 (1997-03),          pages 1492-1501, XP000688100          page 1492, column 2, line 7 -page 1494,          column 2, line 24          page 1495, column 2, line 13 -page 1497,          column 1, line 5</p> <p>----</p> <p>-/-</p>	1,3,7

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

## ° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

27 January 2000

08/02/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
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Authorized officer

Lorne , B

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/00664

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	ELLIOTT STEPHEN J ET AL: "Interaction between multiple feedforward active control systems" IEEE TRANS SPEECH AUDIO PROCESS; IEEE TRANSACTIONS ON SPEECH AND AUDIO PROCESSING OCT 1994 IEEE, NEW YORK, NY, USA, vol. 2, no. 4, October 1994 (1994-10), pages 521-530, XP002128926 cited in the application abstract page 521, column 2, line 20 -page 522, column 1, line 14 page 528, column 1, line 10 -page 529, column 1, line 31 ---	1,3,7
A	GB 2 310 512 A (LOTUS CAR) 27 August 1997 (1997-08-27) page 4, line 19 - line 32; claim 1; figure 4 page 10, line 1 - line 13 page 16, line 21 -page 17, line 20 ---	1,3,7,8
A	WANG B -T: "OPTIMAL PLACEMENT OF MICROPHONES AND PIEZOELECTRIC TRANSDUCER ACTUATORS FOR FAR-FIELD SOUND RADIATION CONTROL" JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA, vol. 99, no. 5, 1 May 1996 (1996-05-01), pages 2975-2984, XP000621087 page 2975, column 1, line 15 -column 2, line 8 page 2979, column 2, line 14 -page 2980, column 1, line 22 ---	1
A	US 5 416 845 A (QUN SHEN) 16 May 1995 (1995-05-16) column 1, line 42 -column 2, line 28 column 2, line 58 -column 3, line 7 column 10, line 32 - line 56 -----	1

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

PCT/US 99/00664

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
GB 2310512	A 27-08-1997	NONE			
US 5416845	A 16-05-1995	AU	6670194 A	21-11-1994	
		CA	2160672 A	10-11-1994	
		EP	0724415 A	07-08-1996	
		JP	8509823 T	15-10-1996	
		WO	9424970 A	10-11-1994	